Health Consultation

Skyline Water System

November 5, 1998

Prepared by
The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

This health consultation was written in response to a request made by the Washington State Department of Health (DOH) Division of Drinking Water to clarify the health risks associated with exposure to trichloroethylene (TCE) in the Skyline Water System (Skyline). The DOH Office of Toxic Substances prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This health consultation will examine new data relative to TCE in Skyline drinking water and discuss the potential health risk associated with exposure to this water.

The Skyline Water System consists of two public wells located between Airway Drive and Route 17 approximately 2 miles south of the Grant County Airport and 2 miles northeast of the City of Moses Lake. These wells serve approximately 80 homes in the immediate vicinity. Well #1 provides continuous service throughout the year while Well #2 is used at times of high demand (e.g. summer months). TCE was first detected in February 1988 at a concentration of 7.5 ppb in Well #2. Sampling in December 1988 detected TCE in both Well #1 at 11.5 ppb and Well #2 at 6.5 ppb. The Washington State Department of Social and Health Services evaluated these levels of TCE in Skyline water in December 1988. This evaluation concluded that drinking water containing TCE above the Maximum Contaminant Level (MCL) of 5.0 parts per billion (pbb) should not be used for drinking or other household uses. [1] A Preliminary Public Health Assessment released by ATSDR in June 1993 concluded that a public health hazard existed for residents drinking Skyline water over a long period of time. [2]

The area surrounding and including the Skyline wells was listed by the U.S. Environmental Protection Agency (EPA) on the National Priorities List (Superfund) as the Moses Lake Wellfield Contamination site (WAD988466355) in October 1992. Much of this area includes the former Larson Air Force Base and Grant County Airport. The EPA is currently requiring that a Remedial Investigation/Feasibility Study (RI/FS) be performed in order to determine the source of the TCE groundwater contamination and the necessary measures to address it. Bottled drinking water has been made available to residents using Skyline water since March 1994.

Since the initial detections in 1988, TCE has been consistently found in each of the Skyline wells. The levels in Well #1 have declined to an average of approximately 5 ppb but have been as high as 6.7 ppb. TCE levels in Well #2 have increased reaching a maximum of 32.2 ppb. The most recent sampling of these wells found TCE in Well #1 at 4.4 ppb (September 1998) and Well #2 at 30 ppb (June 1997). On June 30, 1998, DOH instructed the owner of the Skyline Water System to use Well #2 *only* if Well #1 failed. Well #2 has not been in use since October, 1997.

DISCUSSION

No data is available on TCE levels in the tap water of residents served by Skyline water. Since each well provides water to the distribution system separately, the effect of mixing these two sources on the TCE levels at individual taps is difficult to estimate. Therefore, a worst-case scenario will be evaluated that assumes exposure to the maximum level of TCE in Well #1 (11.5 ppb) for 8 months/year and Well #2 (32.2 ppb) for 4 months/year. This approach is intended to evaluate the highest possible exposure with the understanding that most residents are likely to

have been exposed at lower levels.

TCE in drinking water can get into the body through drinking, skin contact and breathing of vapors that come off the water during household use (e.g. cooking, dish/clothes washing, showering/bathing). Although bottled drinking water has been made available since March 1994, it is not clear that all residents are using it. Therefore, the following discussion of potential cancer and non-cancer health effects assumed that exposure to contaminated water included drinking as well as skin contact and breathing of vapors. The significance of drinking bottled water relative to exposure and health is also discussed.

TCE and Non-cancer Risk

Past and current exposure to TCE in Skyline drinking water is not expected to result in any non-cancerous health problems for most residents. This is because studies of humans and animals have shown that non-cancerous adverse health effects related to TCE exposure occur only at higher levels than what was estimated for Skyline residents. *There is some concern, however, for developmental effects in children born to women who have used Skyline water while pregnant.*

Developmental Health Effects

The developing fetus is often more sensitive to toxic chemicals than children or adults. Exposure to toxic chemicals prior to birth can cause adverse effects on development that include physical birth defects as well as impaired learning and behavior. Developmental health effects also include adverse birth outcomes such as low birth weight, early delivery, spontaneous abortion and stillbirth.

Most of the health effects attributed to TCE exposure have come from studies in animals. Animals given *much higher* amounts of TCE than what would result from exposure to Skyline water have shown health problems related to the liver and kidney. There is also evidence that the developing fetus can be sensitive to TCE in drinking water. Adverse effects on the nervous system along with changes in behavior were found in rats exposed to high doses of TCE prior to birth. One animal study determined that rats exposed to TCE in drinking water while pregnant gave birth to pups with heart defects. [3] This study represents the lowest amount of TCE given to animals that did show a health effect and is supported by limited evidence in humans. This lowest dose that caused these heart related birth defects is still *130 times higher* than the estimated dose received by a pregnant woman exposed to TCE in Skyline drinking water over a 9-month period.

Although this comparison suggests that it would take considerably higher levels of TCE in the Skyline water system to result in such birth defects, it is important to consider the human studies that have associated birth defects in children with exposure to TCE in drinking water prior to birth. The birth defects identified included heart malformations, neural tube defects and oral clefts. Other adverse birth outcomes reported include low birth weight and increased fetal death. [4,5,6,7] Speech and hearing impairment has also been associated with TCE exposure in young children. [8,9] The levels of exposure in these studies are not well defined and in some cases included other contaminants. Some of the studies appear to have involved substantially higher levels of TCE in drinking water than those measured in the Skyline water system while others are similar. One of these studies looked at exposure below the MCL for TCE and did not find a

statistically significant association with adverse birth outcomes. [4] There is no evidence that TCE levels below the MCL can cause any non-cancer health effects.

These studies are suggestive of an association between TCE exposure and developmental effects but are not sufficient to allow an accurate estimate of what the risk might be for Skyline residents. Further study may show no association between the levels of TCE in Skyline wells and this type of health effect. The EPA is currently reviewing all available data on the health effects of TCE in order to provide updated and reliable health effects information. *Until new data are available, it should be assumed that some risk exists for children born to mothers who are exposed while pregnant to current levels of TCE in Skyline drinking water. Exposure during the first three months of pregnancy is of particular concern.* It is likely that this risk is very low based on the data currently available.

Use of Well # 2 (the well with higher TCE levels) has been restricted to emergency situations (i.e., failure of Well #1). Available data indicate that the removal of Well #2 from the water system will reduce the risk for adverse developmental effects provided that levels of TCE in Well #1 do not increase. It is important to note, however, that short term use of Well #2 could still pose a health concern for pregnant women.

TCE and Cancer Risk

A slight increase in cancer risk is expected for residents exposed to TCE in Skyline water for many years. This slight increase in cancer risk was calculated for a 30-year period of a child growing to adulthood exposed to maximum levels of TCE in drinking water via drinking, skin contact and inhalation. Shorter periods of exposure will lower this cancer risk such that residents living at Skyline for only a few years are not expected to have a significant increase in cancer risk. The cancer risk estimated from exposure to TCE at levels below the MCL is not considered to be significant.

TCE was previously classified by EPA as a Group B2 probable human carcinogen based on *adequate* animal data and *insufficient* human data. This classification has since been removed, however, and is pending further review because of new data that has become available. Although EPA has withdrawn its former classification of TCE as a probable human carcinogen, evidence shows that high doses of TCE can cause lung, liver and kidney tumors in animals.

Cancer Risk

Cancer risk estimates do not reach zero no matter how low the level of exposure to a carcinogen. Terms used to describe this risk are defined below as the number of excess cancers expected in a lifetime:

Term		# of Excess Cancers
low	is approximately equal to	1 in 10,000
very low	is approximately equal to	1 in 100,000
slight	is approximately equal to	1 in 1,000,000
insignificant	is less than	1 in 1,000,000

The relevance of cancer caused in laboratory animals at high doses of any chemical is questionable for humans exposed to much lower levels found in the environment. Such animal data are considered to be much stronger when supported by evidence of cancer in humans. There is no clear evidence that any type of cancer has resulted from exposure of humans to TCE. Suggestive evidence indicates that workers exposed to TCE from dry cleaning operations showed an increase in lung, cervical and skin cancer. Dry cleaners also use other chemicals,

however, including tetrachloroethylene (PCE) which could be responsible for this increase. Increases in leukemia were detected in two populations exposed to TCE in drinking water. Both of these populations, one located in Woburn, MA and the other in New Jersey, were also exposed to other chemicals found in the drinking water. [10]

There is much uncertainty in assessing the cancer risk related to the low levels of TCE found in Skyline drinking water. In order to be protective of health, this assessment of cancer risk makes assumptions that may well be over protective. For example, it is likely that long-term exposure has been less than that assumed under the worst-case scenario discussed above since TCE levels in Well #2 were lower in past years. Also, it is assumed that TCE can cause cancer in humans at these low levels which has not been definitively established. However, *the potential exists for continued exposure of some residents to levels of TCE that, if continued over many years, would result in a slight increase in cancer risk.*

Bottled Drinking Water

Bottled drinking water has been made available to all Skyline residents since March 1994. However, not all residents are using bottled water. The above assessment assumed that exposure included drinking as well as skin contact and breathing vapors. The amount of TCE that gets into the body through skin contact and breathing vapors is assumed to be equal to the amount received through drinking. Therefore, residents who use bottled water for drinking could be reducing their exposure by as much as 50 percent. However, some studies indicate that the amount of TCE breathed after showering and other household water use is larger than the amount received by either drinking or skin contact. [11] Any exposure through the air or skin will depend on water use habits, ventilation, water temperature and other factors.

CONCLUSIONS

A potential public health hazard exists for residents exposed to TCE in the Skyline Water System. A slight cancer risk was estimated for those residents exposed over many years to the highest levels of TCE detected. There is also concern that children whose mothers were exposed to TCE in Skyline drinking water while pregnant are at some risk for adverse developmental effects.

The provision of bottled water to residents using Skyline water is not considered to be adequate to eliminate this potential health hazard since TCE can be breathed as a vapor and absorbed through the skin during normal water use such as clothes/dish washing and bathing/showering.

RECOMMENDATIONS

1) Levels of TCE in the Skyline Water System should be reduced below the MCL or an alternative water supply be made available.

Actions

- Bottled water has been made available to Skyline residents since March 1994.
- EPA is currently investigating alternate water sources for Skyline residents.

2) Quarterly monitoring (4 samples per year) of Skyline water should be performed until a new water source is supplied *or* until TCE levels are no longer a threat to exceed the MCL. The Remedial Investigation/Feasibility Study (RI/FS) currently being performed as part of the ongoing Superfund process should provide the necessary data to determine the future threat to the Skyline wells.

Actions

- DOH requires that Skyline wells be sampled quarterly.
- DOH will evaluate the RI/FS data with respect to the potential for future exposure of Skyline residents.

3) A community health education effort should be initiated to help residents better understand the potential health hazards from using Skyline water.

Actions

- DOH distributed a fact sheet to Skyline residents in October 1998 that summarizes this health consultation.
- DOH will evaluate the need for and provide, if necessary, further health education to the Skyline community.

REFERENCES

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